

# Quinolizidine alkaloids in *Lupinus*: when and how are they synthesized?

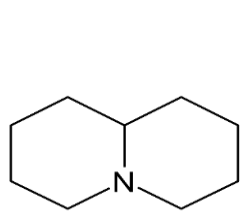
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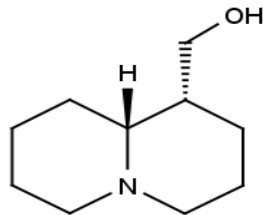


ILC, Cochabamba Bolivia, March 2019

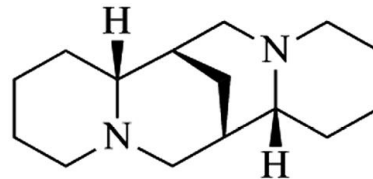
# Quinolizidine alkaloids



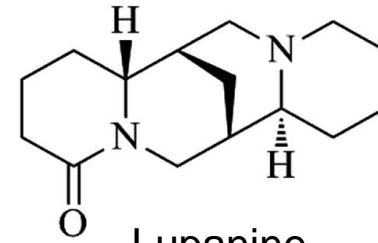
Quinolizidine



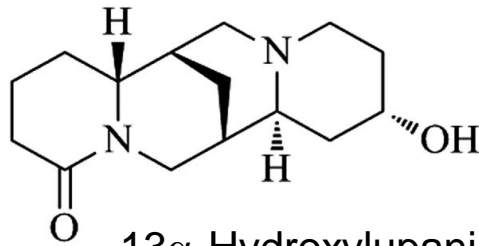
Lupinine



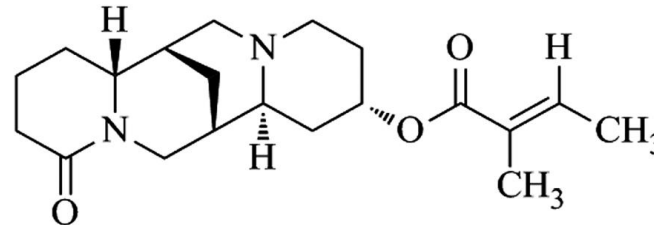
Sparteine



Lupanine



13 $\alpha$ -Hydroxylupanine



13 $\alpha$ -Tigloiloxilupanine



allelopathic  
effect



pollination



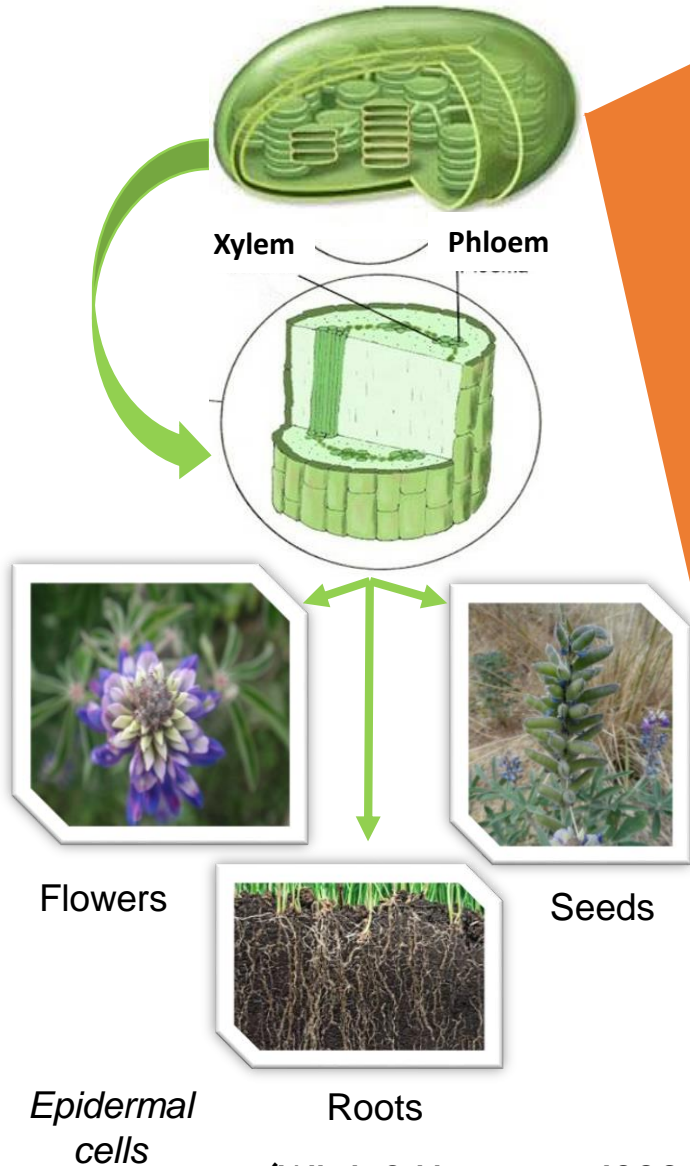
antimicrobial



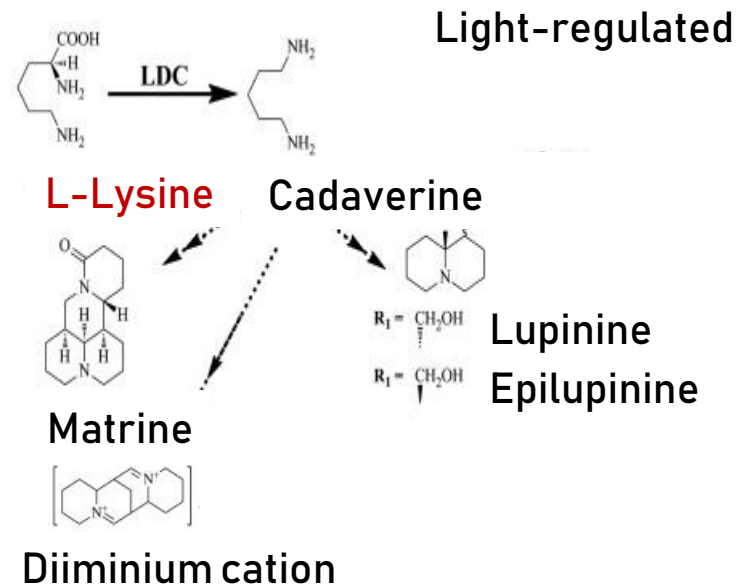
defense against  
herbivores

QA as defense in *Lupinus*

# QA biosynthesis and transport



## Biosynthesis of QA in photosynthetic tissues

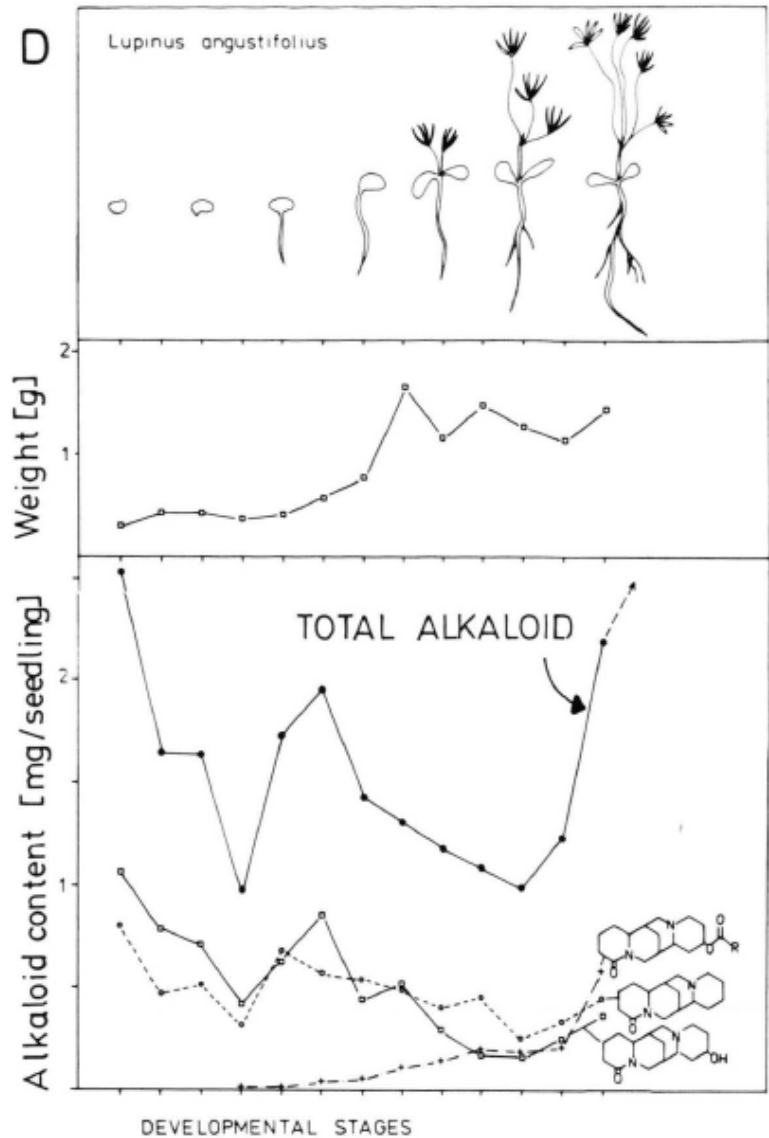
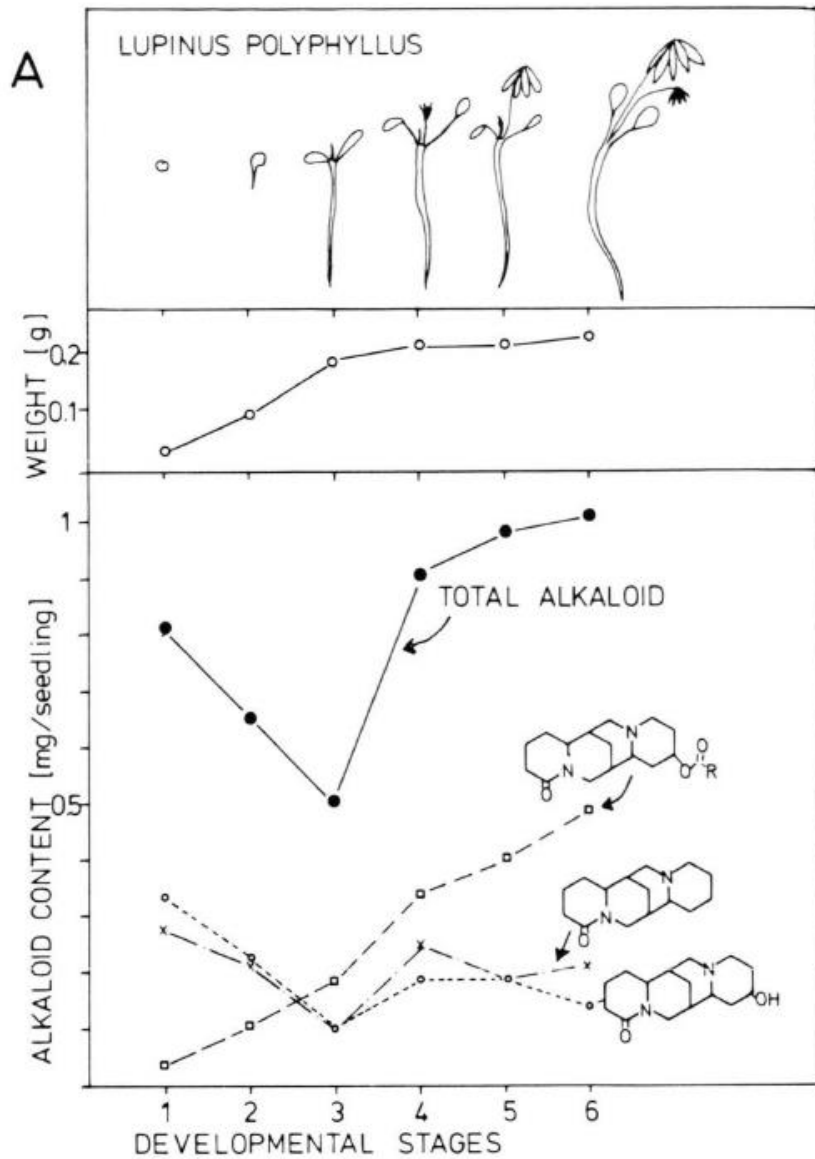


LDC: Lysine decarboxylase

(Wink & Hartman, 1982 ; Wink & Witte, 1983; Lee et al., 2007; Bunsupa *et al.* 2012)



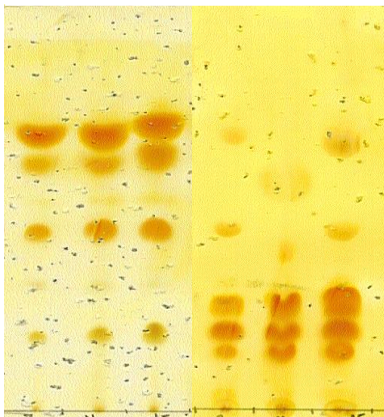
# de novo QA biosynthesis



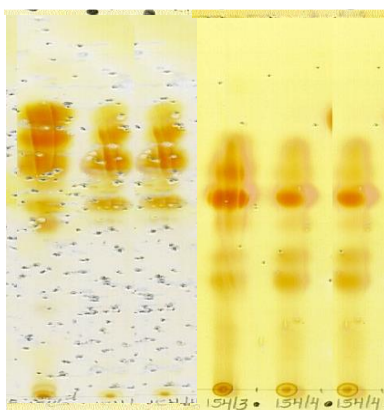
# Mexican lupins



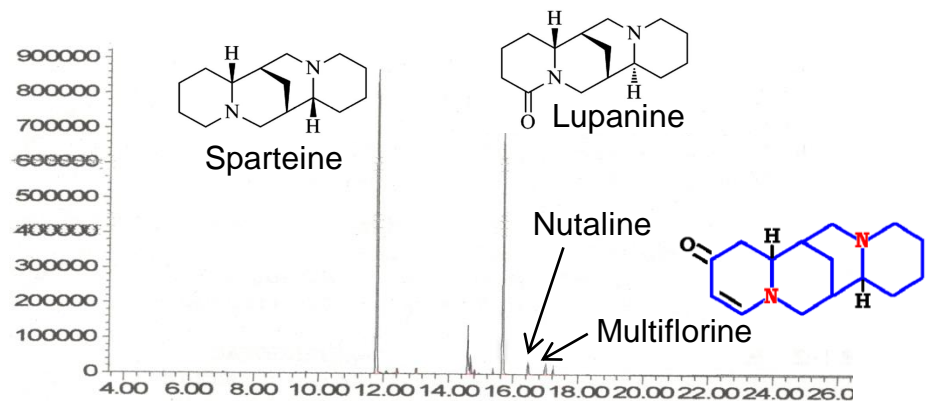
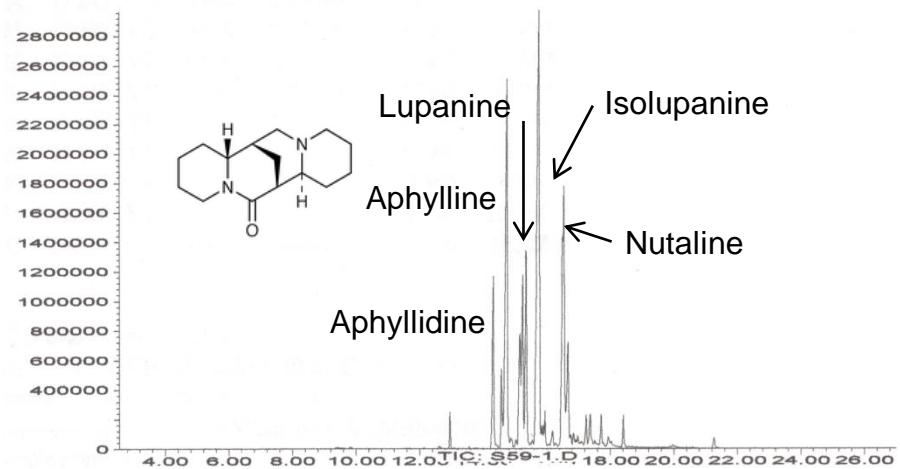
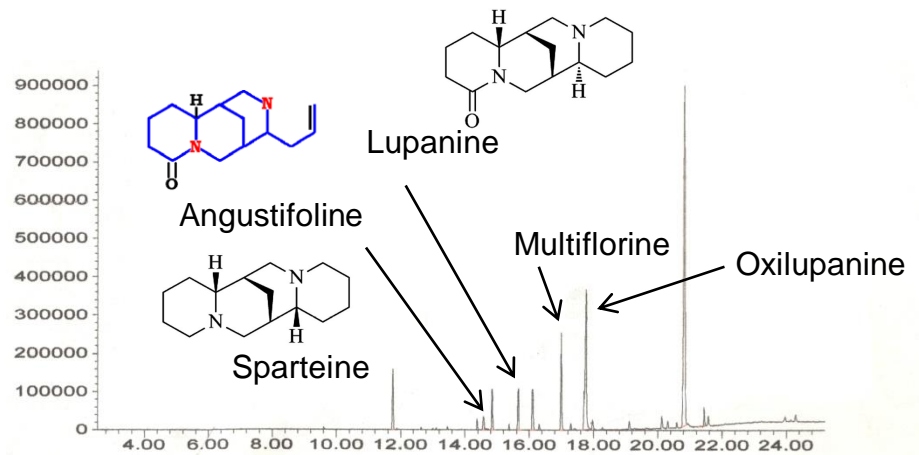
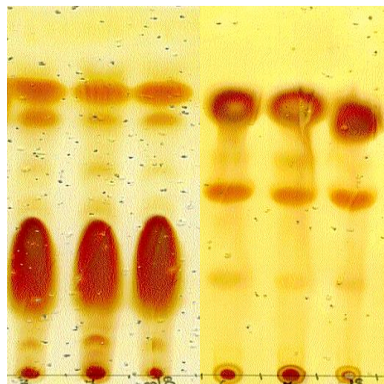
*L. aschenbornii*



*L. bilineatus*



*L. montanus*



# QA biosynthesis



*L. aschenbornii*



*L. bilineatus*



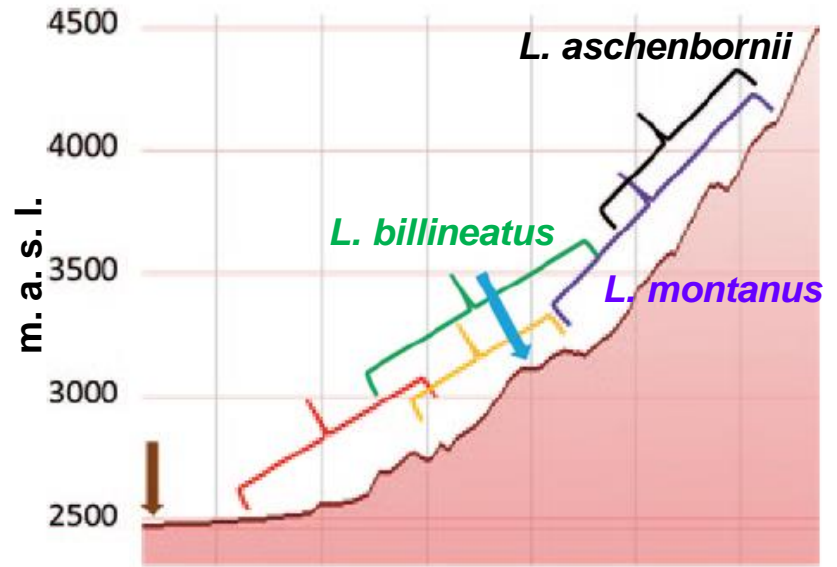
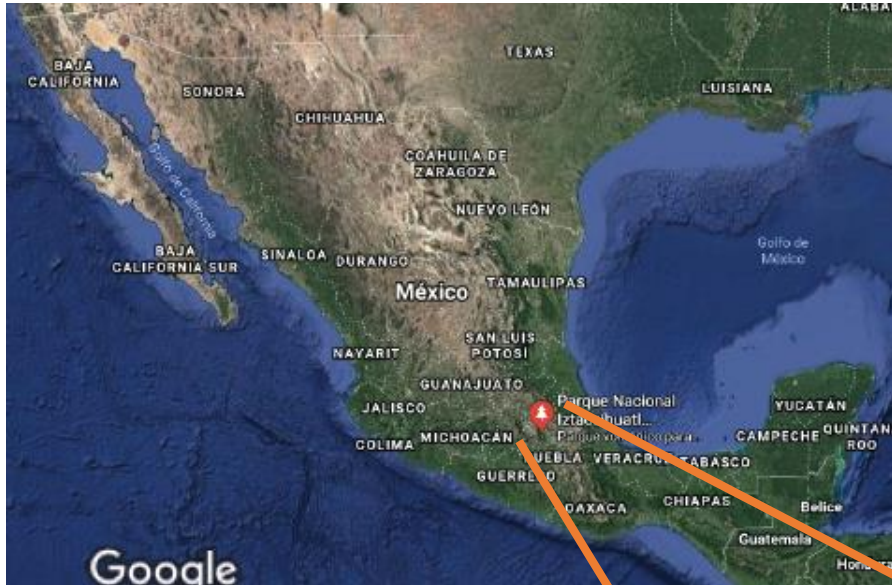
*L. montanus*



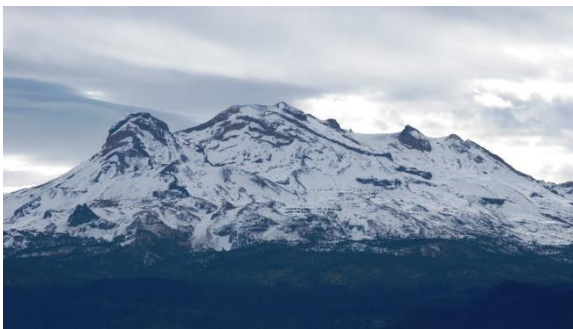
QA used as N source

QA biosynthesis onset and QA diversification, **when and how?**

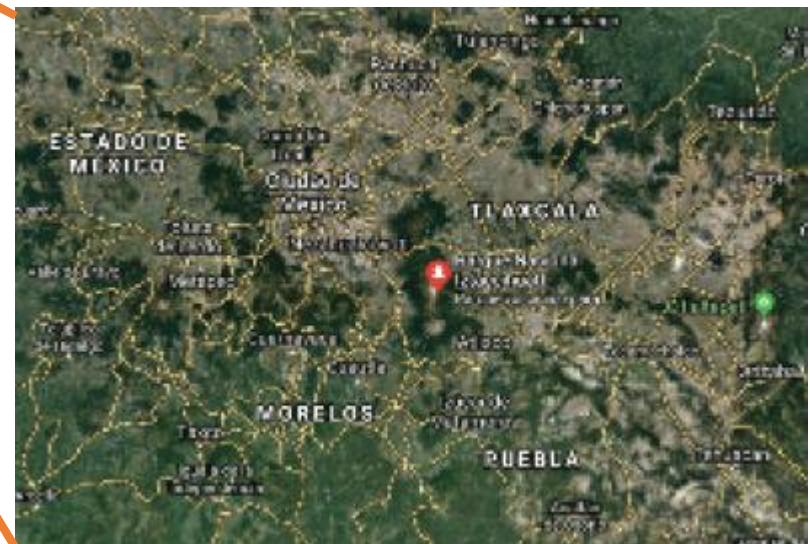
# Seed collection



Altitudinal distribution of *Lupinus* species in the Iztaccihuatl-Popocatepetl



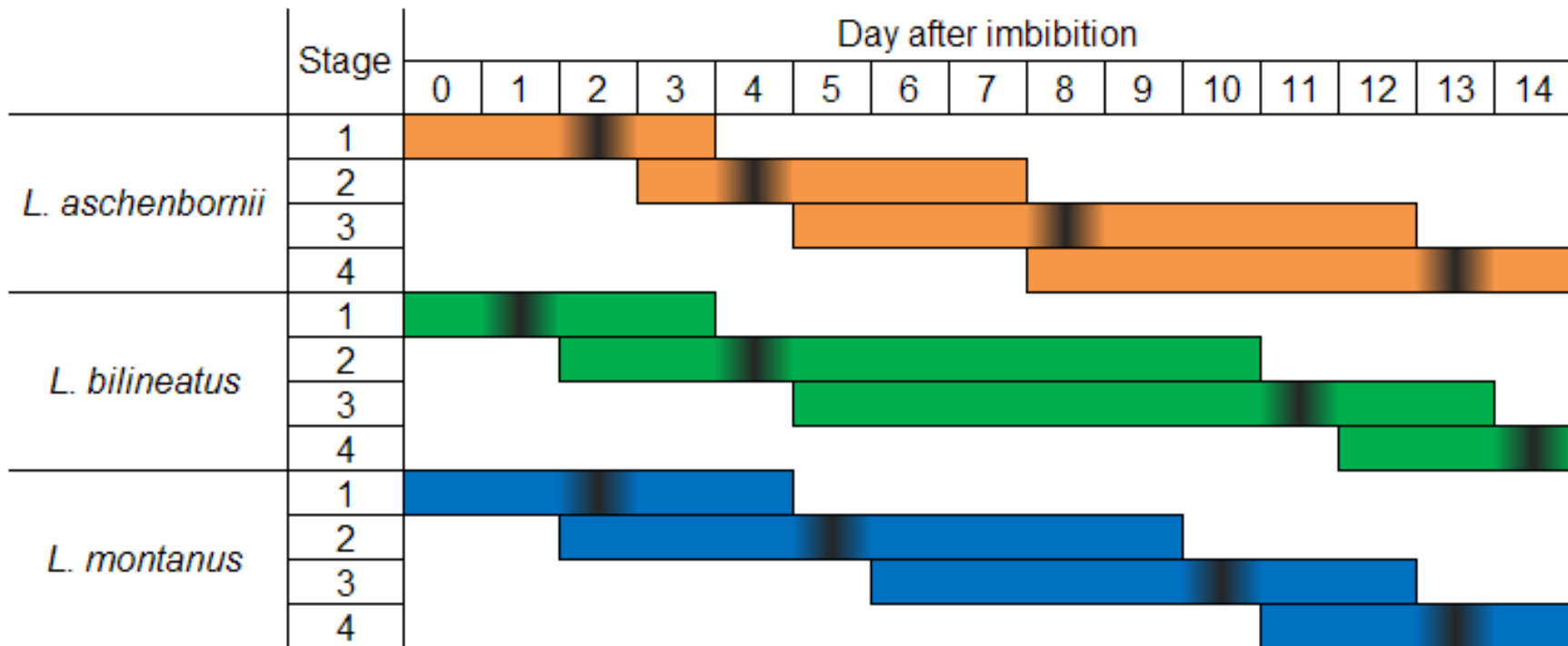
Seeds were obtained from the seed bank of CEPROBI



Bermúdez-Torres *et al* 2015



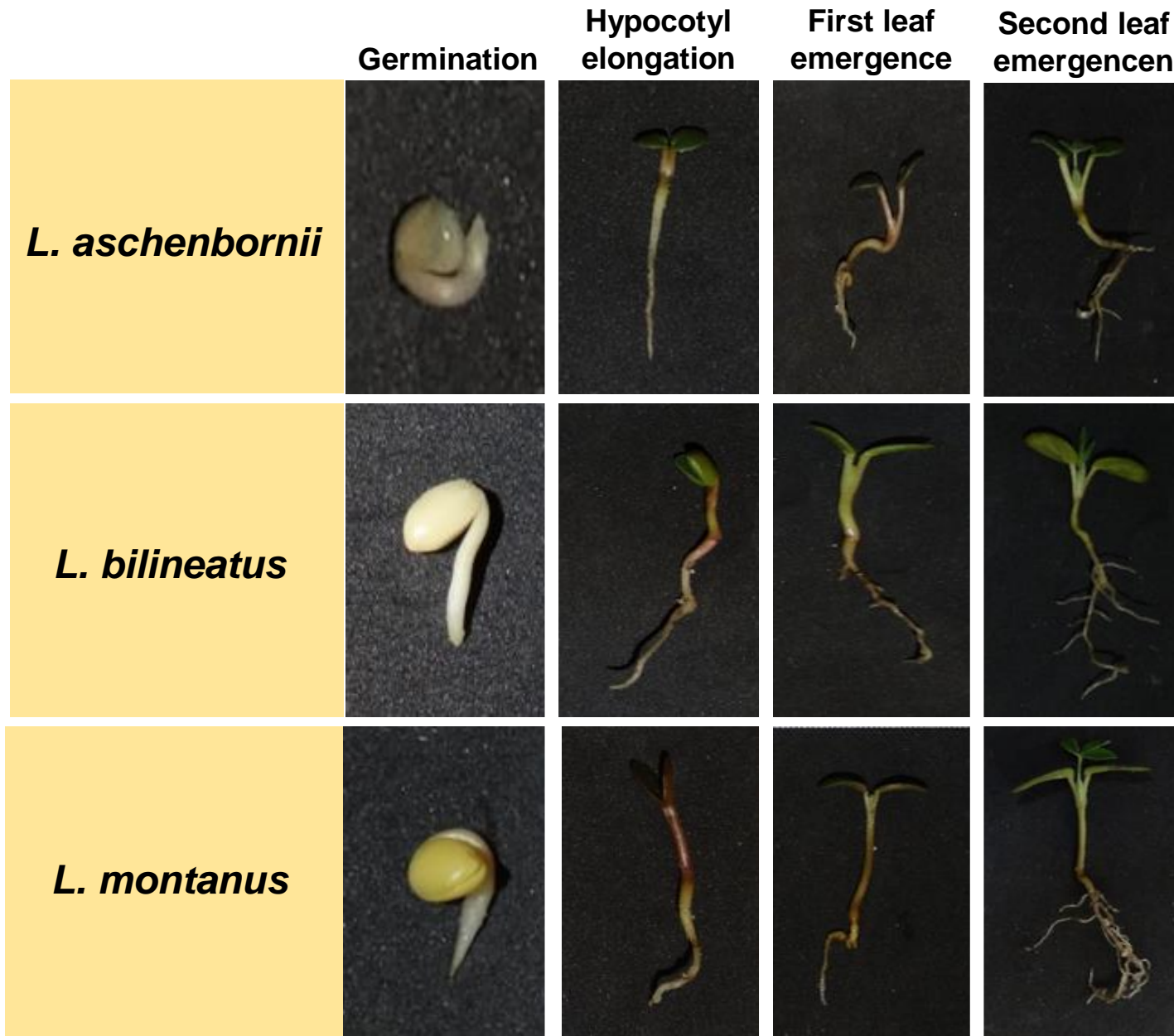
# Mexican lupins development



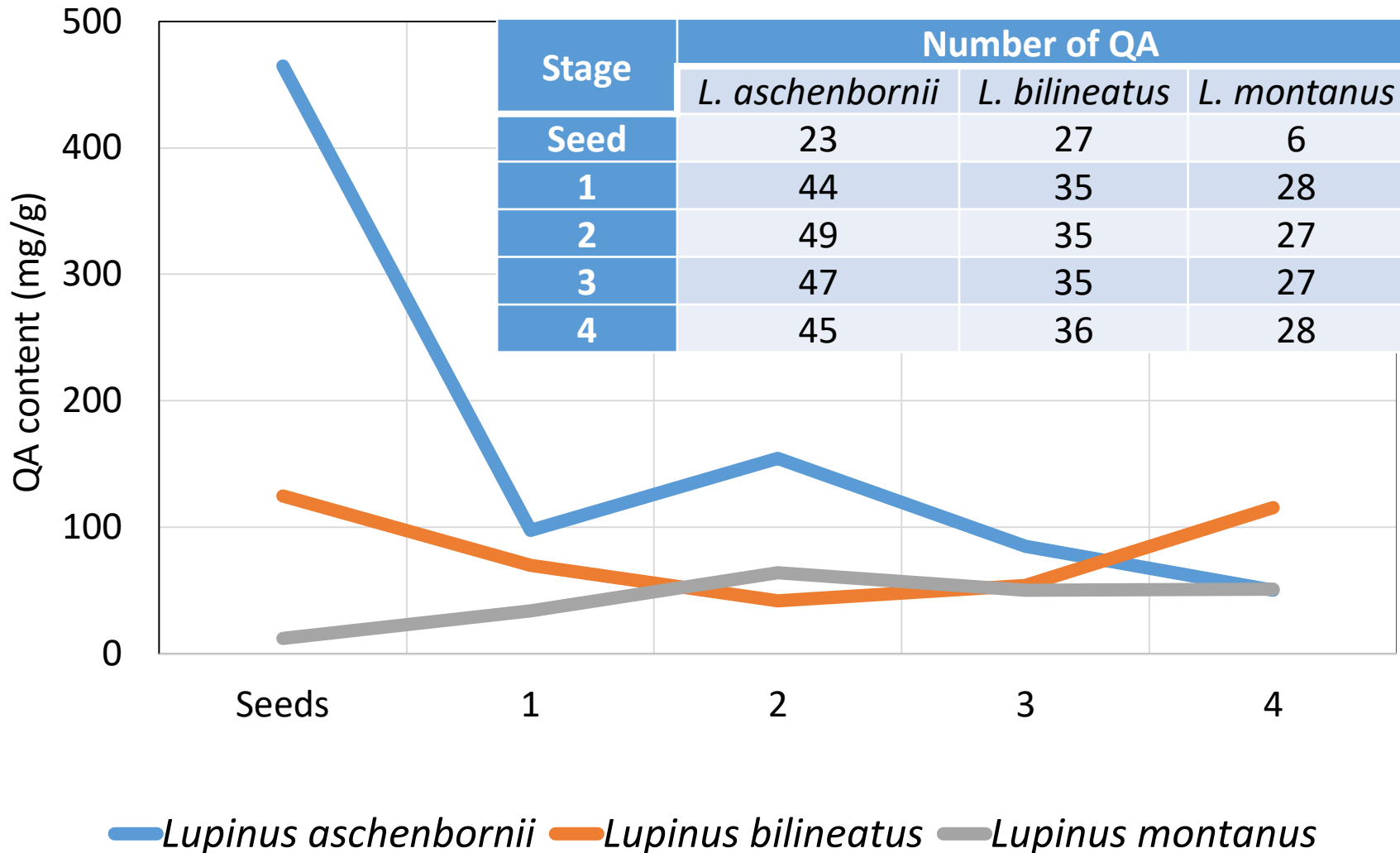
Developmental stages: 1- Germination, 2- Hypocotyl elongation, 3- First leaf emergence, 4- Second leaf emergence

**Grown in agrolite-native soil (10%) at 20 °C, 60% RH and 16/8 h photoperiod**

# Mexican lupins development



# QA content along seedling development



1- Germination, 2- Hypocotyl elongation, 3- First leaf emergence, 4- Second leaf emergence

# Conclusions

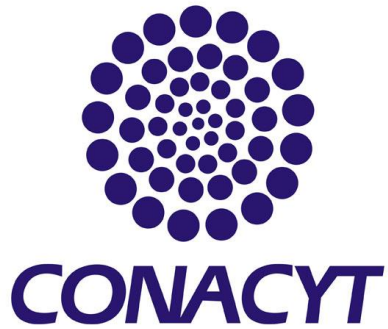
*L. aschenbornii*, *L. montanus* and *L. bilineatus* seedling development differs on the onset time of each developmental stage as well as in its duration.

Quinolizidine alkaloids seem to be used as a source of N during germination of *L. aschenbornii*, *L. bilineatus* and *L. montanus* seeds.

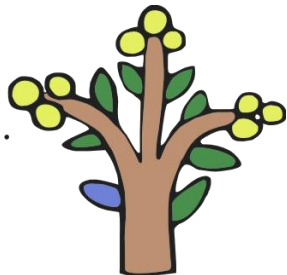
The onset of QA biosynthesis seems to occur after *L. aschenbornii*, *L. montanus* and *L. bilineatus* the second leaf emergence.

Number of QA increases during germination and is highly specific.

# Acknowledgments



Ignacio Regla  
Macdiel E. Acevedo Quiroz  
Jesús Arnoldo Sánchez López  
Estela González  
Norma Robledo



# Thank you!



**Posters: Health Benefits, Non Food Uses, Biochemistry and Biotechnology**